

Lastly, I give two illustrations which will convey an idea of some of my ant-nests.

That on p. 129 represents about a quarter of one of my frames. The shaded part represents the earth, which will be seen to have been arranged by the ants into a sort of circular fortification, or zereba, access to which is obtained by one or two tunnels, not visible in the illustration, and to which a pathway leads from the entrance.

The second (facing this page) represents a nest of *Lasius niger*. It shows the entrance, a vestibule, and two chambers, in the outer and larger one of which the ants have left some pillars, almost as if to support the roof. The queen is surrounded by workers, those in her immediate neighbourhood all having their faces turned towards her. There is a group of pupæ, and several of larvæ, sorted as usual according to ages. There are also a number of the blind woodlice (*Platyarthrus Hoffmannseggii*).

Notes on some of the Birds and Mammals of the Hudson's Bay Company's Territory, and of the Arctic Coast of America.
By JOHN RAE, M.D., LL.D., F.R.S., &c. (Communicated by G. J. ROMANES, F.L.S.)

[Read 16th February, 1888.]

DURING twenty years' residence in various parts of the Hudson's Bay Company's Territory, embracing the extreme south of the shores of James's and Hudson's Bays, and north to the Arctic Sea, I have had, as a sportsman, many opportunities of devoting considerable attention to the habits and peculiarities of animals, especially birds, over a very extensive field of observation, the result of which I shall attempt to give in the following remarks, some of which may possibly be new, other points disputed or perhaps already well known.

My first ten years were spent at Moose Factory, the principal depot of the Hudson's Bay Company in the Southern Department, lat. 51° N., long. 81° W., where the marshes along the coast form the favourite feeding-grounds of a variety of geese, ducks, &c. on their migrations to and from their breeding-places in the north. A great part of my spare time at these seasons, spring and autumn, was spent in shooting these birds, and at the same time acquiring some knowledge of their peculiarities.



Nest of *Lasius niger*, showing the entrance, vestibule, main chamber with pillars, and inner room; the queen surrounded by workers; a group of pupæ, and several of larvæ, sorted according to ages; and the blind woodlice (*Platyarthrus Hoffmannseggii*).

First let me notice that magnificent bird the Canada goose (*Anser canadensis*), probably one of the finest of its kind in the world. This is the earliest arrival of the waterfowl migrants in spring, and makes its appearance at Moose with extreme regularity on the 23rd of April, St. George's day. So much is this the case that, during the ten years of my residence there, we had on every St. George's day a goose for our mess dinner, first seen and shot on that day, and this I learnt from older inhabitants had been the case for many previous years. I may add that this bird arrives with equal punctuality at York Factory in lat. 57° N., 450 miles further north, but a week later.

The Cree Indians, both at Moose and York Factory, assert positively that a small brown bird uses this goose as a convenient means of transport to the north, and that they have been often seen flying off when their aerial conveyance was either shot or shot at. The little passenger has been pointed out to me, but I have forgotten its name, and it certainly makes its appearance on the shores of Hudson's Bay at the same date as this goose, which, by the way, is the only kind that is said to carry passengers*. The natives of the McKenzie River, more than 1000 miles to the north-west, tell the same story. From my observation I am led to believe that there is another species of the Canada goose, much larger, but less numerous†. The male of this larger bird is distinguished by a ruddy-brown colour of plumage on the breast, by the greater loudness and sonorousness of its call, and by its much greater size, so that a difference is made in the quantity served out as rations to the men. The line of flight is also different, as they generally pass by Rupert's River about 100 miles east of Moose, but a few are sometimes to be

* Since this paper was read, an article by J. E. Harting, on "Small birds assisted on their migrations by larger ones," has appeared in the Natural History columns of 'The Field' of March 31st, 1888, in which will be found much additional information on the subject.—J. R.

† Baird, Brewer, and Ridgway in their 'Water Birds of North America' recognize two species of Canada Goose—a large species with 18 to 20 tail-feathers, and a smaller one with 13 to 16 tail-feathers. Each of these supposed species they subdivide into two races, a grey and a brown one. Dr. Elliott Coues, in his 'Key to North-American Birds' (2nd ed. 1884, p. 689), remarks "there seems little probability of establishing good characters for more than one species of the *canadensis* group, with probably four varieties:—(1) large, no collar (702, *canadensis*); (2) small, no collar (704, *hutchinsi*); (3) large, collared (702 a, *occipitalis*); (4) small, collared (703, *leucoparcia*)." The two larger ones both have 18 tail-feathers; the two smaller ones 16 only.—ED.

obtained at the latter place, which afforded me an opportunity of comparing them with the more common or smaller kind. This *Anser canadensis* (major?), instead of being seen feeding in the marshes as the others do in autumn, chiefly frequents the higher and more rocky grounds on the eastern shores of James's Bay, where its principal food consists of berries of various kinds.

By far the most numerous of the goose tribe that visit the Moose marshes in the autumn are the snow goose, or white-wavy (*Anser hyperboreus*), and the blue-winged goose of Edwards (*Anser caerulescens*). These birds resemble each other very much in size, call, and form, but not in colour; and as they often feed in proximity, the blue goose was for a long time supposed to be merely the young of the snow goose; an erroneous opinion, which I endeavoured to correct in a little book published in 1850 by Boone, entitled 'Expedition to the Shores of the Polar Sea 1846-47.'*

These snow and blue-winged geese have a peculiarity I have never noticed in any other species. Previous to taking their southern flight from Hudson's Bay some time in October, they remain for several days almost constantly on the open sea, washing themselves, taking sudden and rapid flights, apparently having a "happy time," but they are never seen feeding. They are at this time very fat, and when shot, their stomachs and intestines are found to be entirely empty, resembling in this respect salmon, I am told, prior to, and in preparation for, their hard work in ascending rivers to their spawning-beds. After this period of fasting, ablution, and exercise has been gone through, the birds are evidently ready to start on their flight of some hundreds of miles. On the first favourable opportunity, which means a northerly wind, they take wing in batches of fifty or more, circling round until they attain a safe altitude, and then bear away on a true southerly course, never resting until they reach winter-quarters, on the shores or swamps of the Southern States †.

* The specific distinctness of these two geese is generally admitted by modern ornithologists.—ED.

† I may mention that 45 years ago the blue-winged and white-wavy geese visited Moose in about equal numbers, as they still do; whereas at Albany, 100 miles to the north, there were great numbers of the white bird and scarcely a blue-wing to be seen. Now the two kinds are about equally abundant there, whilst at Rupert's River, 100 miles east of Moose, now, as formerly, the blue-winged birds are alone met with.—J. R.

The Canada goose, on the contrary, stops by the way to feed, especially on the lakes and swamps where there is wild rice, which makes both geese and ducks much finer eating than any other kind of food I know. Both the white and blue wavy are excellent eating, and one of them with a pound of flour or bread, is given as a day's rations, and is much liked by the men, especially when fresh. Many thousands are annually cured with salt, and packed in barrels for use at the Hudson's Bay Company's stations on the coast; and the Indians bone and dry a great number for winter food.

All species of grouse in British North America have a well known habit of passing the night under the snow, during the winter, to protect themselves from the cold; but possibly a practice which most of them follow more or less when the snow is not too hard packed may not have been generally observed. The bird is not content to make its resting place close to the door by which it has entered the snow, but usually bores a tunnel a few inches under the surface, three or more feet in length, before settling down for the night. The cause for going through so much, apparently, useless labour was at first difficult to understand, for its bed would have been equally warm had the bird remained within a foot of where it had entered the snow, but a little more experience taught me to admire the acuteness and intelligence of the proceeding, for during my walks in the woods I frequently came to places where a fox, lynx, or other carnivore had in the night approached cautiously (judging by the short steps) and made a long spring on the entrance hole; the occupant was not there, however, but had flown up 3 or 4 feet off, as seen by its exit in the snow, and was thus saved from almost certain death.

The prairie-hen, which is fairly numerous near Moose, shows great carefulness in this respect, and in very cold weather takes its "siesta" between breakfast and supper under the snow, out of which I have often seen them pop their heads, without taking wing, before I had got within shot, no doubt to observe if an enemy were approaching.

Without counting the small white grouse peculiar to the Rocky Mountains, I believe there are three other species to be found at or near the Arctic coast.

First and chief among these is the Willow-grouse (*T. saliceti*), by far the most numerous, and forming an important article of

food for the Indians living near the coast of Hudson's Bay. These birds extend their breeding-grounds up to the Arctic shores of America, but as a rule do not extend their migrations to the large islands further north.

Dr. Bell says:—"The summer plumage of *Tetrao saliceti*, the cock bird, is exactly the colour of the English cock pheasant with the exception of the wings, which have a good deal of white, and in winter the white of the living bird has a beautiful delicate rosy tint, which forms a considerable contrast with the surrounding snow."* This description is somewhat misleading. The plumage of the cock willow-grouse in summer resembles as nearly as possible that of the Scottish grouse, with the exception that the primary feathers of the wings of the former are *always* white. The "delicate rosy tint of the white plumage" is rarely seen, and only in beautiful warm sunny winter or spring days, *never* on a cold winter day. In the spring, or pairing season, the call and peculiar habits of the Willow and Scottish cock Grouse exactly resemble each other.

The Rock Grouse (*Tetrao rupestris*) is so well marked by its smaller size, its more slender beak, and the black patch extending from the angle of its mouth to the eye in the male, that it cannot be mistaken for any other.

A third species differs considerably from *Tetrao saliceti* and *rupestris*, being fully as large as the former, but the bill seems shorter, its feet smaller, and its call perfectly different from either of the others; it is also found further to the north. I saw a good many males (the hens were nesting) on Wollaston Land, lat. 69° N., in May and early June, and managed to shoot a few, although they were very wild, possibly with the intention of leading me away from the nest †.

At Toronto, Lake Ontario, Canada, an island forms an excellent harbour. Along the outer side of this island an immense number of a small sandpiper, called "black heart" (the Dunlin, *Tringa alpina pacifica*), pass northward every season on the 23rd April (St. George's day) and are not seen on any other day, except, perhaps, some wounded ones on the 24th that cannot continue

* See "Notes on Birds of Hudson's Bay" by Robert Bell, M.D. Proceedings of the Royal Society of Canada for 1882, vol. i. p. 49.—J. R.

† There is, I think, a specimen of this bird in the Natural History Museum at South Kensington called *Tetrao mutus*, but certain distinguished naturalists do not believe in it. I brought one or two specimens from the Arctic regions in 1847, which were presented to the British Museum.—J. R.

their flight. This flight is so well known that many sportsmen line the shores of the island on the day named, and hundreds of these pretty little birds, which are good eating, are shot. Persons who have resided many years in Toronto have told me that they did not remember an instance of variation in the date of the arrival of these birds.

Over almost every part of the wooded country of British North America, east of the Rocky Mountains, the American hare (*Lepus americanus*), usually called the "rabbit" by the Hudson's Bay Company's people, is to be found in more or less abundance, and it may not be generally known that every ten years these animals are attacked by an epidemic so fatal, that from being very numerous they gradually die off until scarcely one is to be seen. The survival of the fittest then begins to increase, and at the end of ten years they are again at their maximum. I have myself seen two of those cycles, and know men in the Hudson's Bay Co's. service, who have witnessed four or five of such events.

The latest years of abundance were 1885 and 1886, the hares having increased gradually from 1880-81, which were years of scarcity. The curious thing is that this takes place in the same years over an extent of country about as large as one fourth of Europe. It has been asserted by distinguished naturalists, among them by my friend Sir John Richardson, that the hares migrate; but this cannot be the case, for it is not known where they go to, besides they are found sitting in their "forms" dead, usually under small pine or spruce trees, the branches of which grow close to the ground. I account for the disease in this way. The hares do not spread themselves broadcast all over the country, but live in colonies extending over a square mile or more, where the trees and plants on which they feed are abundant, and here they become so crowded together that the ground gets poisoned by their excreta, as is the case with domestic poultry when kept too long on the same land without being cleaned or shifted, and hence disease. The grouse disease in Scotland I attribute to the same cause, when too large a stock has been left on the moors. When the grouse "pack," they have in winter some favourite resort to which they fly during storms (chiefly from the west) for shelter, and I have seen such places perfectly covered with droppings, even in Orkney, where grouse are never very numerous.

The effect of these epidemics among the hares is peculiar, and affects both the Indians and some of the fur-bearing animals, as I shall endeavour to explain.

When the hares are abundant, an Indian and his family pitch their tent among them in winter, and cut down a number of the trees, part of which forms the hares' favourite food, then make barriers of small pine trees and brush, through which gaps are cut to allow the hares to run through. Allowing them a short time to fatten up on the abundant food provided for them, a hundred snares, or more, are set in the openings of the barriers, and these snares are attended to by the wife and children of the hunter, whilst he sets up a number of traps in two or three directions to the distance of perhaps eight or ten miles from his tent, each of which he visits two or three times a week to bring home the fur-bearing animals caught, chiefly fox, lynx, fisher, and marten, taking with him on each visit a supply of fresh baits. The Indian is thus carrying on his winter hunt in the most advantageous manner, the hares attracting the carnivora above named to his traps, whilst at the same time they supply, without any difficulty, an abundance of food and the most comfortable winter blankets known. The making of these blankets is peculiar; the hare skins, after being cut into strips, are stitched end to end, and plaited so loosely that the finger can be poked through them in any direction, yet a person can sleep comfortably wrapped up in one of these on the coldest night, with the temperature say 40° below zero, without any fire.

When the hares become scarce, not only has the Indian to travel about in search of large game, or go fishing to obtain food for himself and family, but the fur-bearing animals have also to wander abroad; consequently the Indian cannot catch so many hares, and they have time to increase and multiply until a season of abundance again comes round.

The house-building habits of the muskrat in nearly every part of British North America are well known, but there is one plan to which it sometimes resorts under certain circumstances which appears to show great intelligence in enabling it to get its food more readily. The muskrat, when about to build its house, selects a pond or swamp of good pure water, on the bottom of which grow the plants which constitute its winter supply of food. If the pond or swamp is of considerable extent, and the house a large one containing many rats, they, when the water begins to freeze in early winter, keep several holes open in the ice in different directions, and at a distance from the house, and build a little hut of mud and weeds (just large enough to hold one rat comfortably) over each hole which—especially when covered with

snow—prevents it freezing up. These huts enable the rats to extend their feeding ground to all parts of the pond, which could not be reached at all, or with difficulty, from the house if they had to swim home every time with a mouthful of food, to eat it. With these little shelters they are saved a great amount of labour and are enabled to reach all the food in the pond.* I remember, when on a snow-shoe journey, one of my men went very quietly up to one of these miniature mud huts, and knocked it over with his axe, disclosing a live rat with some of the food it had been eating. The practice of building these little eating huts is by no means common, and does not seem to be resorted to when the pond is of moderate dimensions, and all parts of it can be reached from the house without difficulty.

I am not aware if it is generally known that the lemmings (*Myodes hudsonicus*, &c.) of North America migrate much in the same manner as do those of Norway and Sweden. When travelling in June 1851 southward from the Arctic coast along the west bank of the Coppermine River, and north of the Arctic Circle, we met with thousands of these lemmings speeding northward, and as the ice on some of the smaller streams had broken up, it was amusing to see these little creatures running backwards and forwards along the banks looking for a smooth place with slow current at which to swim across. Having found this, they at once jumped in, swam very fast, and on reaching the opposite side gave themselves a good shake as a dog would, and continued their journey as if nothing had happened. At that date the sun was above the horizon all hours of the 24, and we were travelling by night to avoid the snow-glare in our eyes, the sun being then in our rear. As the lemmings appeared to travel only by night, we should not have seen them had we been travelling in the daytime, for they then hide themselves under the snow, or stones. The man who was carrying our cooking utensils and small supply of provisions, having, when fording a stream, been swept into a deep hole by the current, whereby his whole load was lost, we had, for a day or two, to live chiefly on lemmings roasted between thin plates of limestone, and found them very fat and good. Our dogs easily killed as many as they required. Prior to this, whilst on the coast, crossing the ice to islands some miles distant, a lemming was noticed defending

* The beaver, especially when its dam is large, scrapes holes in the banks from under water upwards until above the water-level, to which it retires to feed instead of going back to its house.—J. R.

itself most gallantly against the attack of two large gulls, which continued swooping down at it, but were kept at bay by the brave little animal turning on its back and squealing loudly. I ran up and was in time to drive away its dangerous opponents, and place it in safe shelter under a piece of ice.

Occasionally large numbers of lemmings are found drowned along the shores of James's Bay, but as they are generally seen after a very high tide, it is uncertain whether they are then migrating, or merely caught by the high tide on their native grounds. As soon as snow falls to any considerable depth, the lemming leaves its summer quarters in the ground, and builds a bed of grass and moss as a winter shelter, from which it bores under the snow in one or more directions to obtain food. They do not seem to hibernate during the winter, for when wintering in a snow-hut at Repulse Bay in 1853-4 I used to hear them scratching tracks through the snow throughout the cold season*.

The Arctic hare (*Lepus glacialis*), of which I have seen and shot a good many, shows a considerable amount of intelligence in its efforts to throw foxes, wolves, and other enemies off the scent. It seems to have been eminently successful in this respect with the crew of McClure's ship when wintering in Prince of Wales's Strait, if it were not from bad shooting on the part of the men, for we are told that although hundreds of hares were seen, the total bag in a month was only seven hares!

The Arctic hare, after its night's feed, usually goes some distance from its feeding-ground before settling down in its form for the day. When following up the track, I was at first extremely puzzled to find all at once a complication of tracks, and on going a little further found no track at all. On retracing my steps and carefully examining the snow, I observed two very small marks, at least 20 feet distant, from the main track. A succession of two or three similar long jumps followed, and a very little experience taught me that the hare was always crouching near; usually close to some large stones or rock uncovered by snow. These long jumps were invariably made to *leeward* for obvious reasons, because if to windward a fox would have scented his prey.

* Many lemmings were seen at the winter quarters of the Nares Arctic Expedition, in lat. 82°, and a large "cache" of dead ones was found, made by a white fox.—J. R.

Even after becoming acquainted with this artful dodge, the hare must be stalked with caution. Being all white except the tips of its ears, it is not easily seen when nearly buried in the snow, and when discovered the sportsman must dissemble, and pretend that he has not seen it, walking in an oblique direction, approaching, but at the same time as if passing by, never looking directly at the game. When near enough he should wheel suddenly round and fire. If this plan be not adopted, the hare will very generally bolt round the rock, and escape under its shelter. This may be called *pot* shooting, but the best of sportsmen have often to do the same thing with ptarmigan in the Scottish mountains, when these birds fly round a rock and are out of sight in an instant, if not shot before taking wing.

Copepoda of Madeira and the Canary Islands, with Descriptions of New Genera and Species. By ISAAC C. THOMPSON, F.R.M.S. (Communicated by Prof. HERDMAN, F.L.S.)

[Read 17th November, 1887.]

(PLATES X.-XIII.)

DURING the spring of 1887, in company with Mr. W. S. McMillan, of Liverpool, I visited Madeira and the Canary Islands with the object of collecting and examining the pelagic fauna at the various convenient stopping-places.

We took dredge and tow-net, and all the necessary appliances for the examination and preservation of specimens, and were fortunate in securing a large mass of material.

It is intended in this paper to treat of the Copepoda only; and as the dredging operations were neither so practicable, nor fruitful in results as the tow-netting, it was to the latter that we devoted chief attention, all the Copepoda collected being free-swimming species.

We used one of the very fine-meshed tow-nets of the 'Challenger' pattern, and immediately preserved the captures in a medium which I have always found useful for small Crustacea, composed of glycerine, alcohol, and water in the following proportions:—

Glycerine.....	1 part	} adding 1 per cent. of carbolic acid.
Proof-spirit...	2 parts	
Water	1 part	